

29 July 2004

COMMANDING OFFICER

NOAA Fisheries Research Vessel Delaware II

CRUISE INSTRUCTIONS: 04-13, Atlantic Herring Hydroacoustic Survey

Cruise Period: On or about 7 September - 15 October 2004.

Area of Operation: The continental shelf (depths to 300 m) in the Gulf of Maine and Georges Bank regions, including the Canadian Exclusive Economic Zone on eastern Georges Bank (Fig. 1).

Objectives: Operational objectives are to (1) calibrate the EK500 Scientific Sounder, (2) conduct hydroacoustic surveys of selected Atlantic herring spawning stocks, (3) collect biological data to verify species-specific acoustic measurements using midwater trawls and underwater video, and (4) collect *in-situ* multi-frequency target strength (TS) measurements on herring. The primary goal is to provide improved fisheries-independent abundance estimates of Atlantic herring in the Georges Bank and Gulf of Maine regions using advanced technologies.

Itinerary (planned): The cruise will be divided into three parts:

Part 1: 7-17 September 2004

7 September: Onload scientific equipment, embark personnel, calibrate the EK500 (38 and 120 kHz) at the Woods Hole Oceanographic pier, and depart from Woods Hole, Massachusetts.

7 September: Conduct EK500 calibrations (18 kHz) in waters no less than 50 m depth in Cape Cod Bay.

8-16 September: Conduct herring acoustic survey in the Gulf of Maine and Georges Bank regions, and collect *in-situ* TS measurements using the EK500.

17 September: Arrive in Woods Hole, Massachusetts to disembark personnel.

Part 2: 20 September - 1 October 2004

20 September: Embark personnel, and depart from Woods Hole, Massachusetts.

20 Sept.-1 October: Conduct herring acoustic surveys and conduct *in-situ* TS experiments in the Gulf of Maine and Georges Bank region.

1 October: Arrive in Woods Hole, Massachusetts to disembark personnel.

Part 3: 4-15 October 2004

4 October: Embark personnel, and depart from Woods Hole, Massachusetts.

4-15 October: Conduct herring acoustic survey operations, TS experiments, and seabed habitat classification in the Georges Bank and Gulf of Maine region.

15 October: Arrive in Woods Hole, Massachusetts to disembark personnel, and offload scientific equipment.

Operational plans for Part 1:

Part 1 will begin with calibrations of the RV Delaware's Simrad EK500 Scientific Sounder. The EK500's 38 and 120 kHz split-beam transducers will be calibrated at the Woods Hole Oceanographic Institution's pier (approximately in 20 m water depth) on the day of departure. Upon completing the 38 and 128 kHz calibrations, the EK500's 18 kHz transducer will be calibrated while drifting in waters no less than 50 m in the vicinity of Cape Cod Bay. Upon successful EK500 calibrations and testing of scientific sampling gear (e.g., midwater trawl, underwater video, CTD), survey operations will be conducted in the Gulf of Maine region. Survey operations will include EK500 acoustic data acquisition, midwater trawling, CTD profiles, and underwater video observations. During survey operations, the vessel may be intermittently stop to collect individual acoustic target strength (TS) measurements, particularly when trawl catches are comprised of predominantly single-species (> 90% by numbers) composition. The RV Delaware will coordinate its survey operations and conduct inter-vessel comparisons in conjunction with chartered commercial vessels that are assisting with the cooperative herring acoustic surveys.

Operational plans for Parts 2:

Part 2 will be devoted to a systematic herring acoustic survey along northern Georges Bank and Gulf of Maine regions. Standard EK500 operations with midwater trawl, underwater video, and CTD operations will be routinely conducted during Part 2. Survey operations will include TS deployments using a towbody equipped with underwater video and transducer at selected stations.

Operational plans for Part 3:

Part 3 will be devoted primarily to experimental transects on Georges Bank to investigate the diel variability of individual target strength (TS) measurements of herring on northern Georges Bank. Additional survey operations may be completed on northern Georges Bank to examine spatial variability in herring biomass estimates. Acoustic seabed habitat classification operations will also be conducted using EK500 and QTC instrumentation in the Georges Bank and Gulf of Maine regions during Part 3.

Hydroacoustic survey operations:

Systematic acoustic surveys will be completed on selected historical spawning areas of Atlantic herring (*Clupea harengus*) in the Gulf of Maine and Georges Bank regions during parts 1, 2, and 3 (Fig. 1). An adaptive systematic survey will include transects arranged in an evenly spaced parallel survey design. The beginning and ending locations of the transects are pre-defined, however, the transects may be extended when herring aggregations are encountered at the end of the transect. EK500 survey operations will be conducted continuously throughout the cruise track at a constant ship speed of 10 ± 1 knots, and during scientific gear deployments. Vessel speed may be reduced to no less than 8 knots during rough seas, and EK500 operations typically stopped when seas exceed 2 m to eliminate noise from surface waves. Each transect will be assigned a sequential number throughout the cruise. A transect is defined as a portion of the cruise track with a constant heading and ship speed. All scientific gear deployments will also be assigned a unique sequential deployment number. Midwater trawl, CTD, and underwater video deployments will be completed on selected backscatter aggregations observed from the EK500 echograms. Navigational, meteorological, and environmental data will be archived throughout the cruise using the RV Delaware's Fisheries Scientific Computer System (FSCS).

Individual acoustic target strength (TS) measurements:

Individual TS measurements will be collected on selected single-species aggregations (defined as trawl catches comprised of 90% or more of a single species by number). During TS measurements, the vessel may reposition on backscatter aggregations, deploy a towbody equipped with transducers, drift for 30-60 minutes, and

then deploy underwater video for direct observations. TS measurements will be collected intermittently during survey operations and during 24 hour site-specific experiments to investigate diurnal variability in the TS measurements.

Simrad EK500 Scientific Sounder: The Simrad EK500 Scientific Sounder will be the primary sampling gear used during fisheries acoustic surveys for providing species-specific abundance estimates. The EK500 will operate three hull-mounted transducers (18, 38, and 120 kHz split-beam transducers) continuously throughout the cruise track and deployments. The EK500 will be TCP/IP ETHERNET interfaced to the RV Delaware's FSCS server for data logging using SonarData EchoLog software. RS232 connections are used for navigational (Differential GPS) input. The EK500 is hard-wired to the external trigger of the Furuno omni-directional sonar to eliminate cross-interference during sonar operations. An EchoConfig script file will be executed to start EK500 data acquisition to ensure that the same parameter settings are used throughout the cruise. The FSCS Event Logger will be used to record all operational events (e.g., begin and end points of transects, stations, gear deployments, and other events that affect the track cruise and vessel speed) during the cruise.

Calibrations and Ambient Noise Tests of the EK500: The 38 and 120 kHz split-beam transducers will be calibrated dock-side at the Woods Hole Oceanographic Institution's pier (in water of 20 m depth) on the day of departure. The calibrations are necessary to ensure that the EK500 is operating properly to obtain accurate population estimates. The EK500 is calibrated by suspending a standard calibration sphere of known target strength under each transducer from three monofilament lines. For the split-beam 38 and 120 kHz transducers, a sphere is centered at about 10-14 m depth and moved throughout the acoustical beam beneath the vessel using remotely controlled downriggers. The 18 kHz transducer must be calibrated in water depths of no less than 50 m (the sphere must be suspended outside the 25 m nearfield of the transducer), therefore the 18 kHz calibration will occur in Cape Cod Bay or the Gulf of Maine while drifting. Each frequency requires about 6-12 hours to center the sphere and map the beam pattern to complete the calibration, provided mild weather and tidal conditions.

SonarData Echoview Post-processor: SonarData software (v. 3.0) will be used for data acquisition and post-processing of EK500 data during the cruise. SonarData Echoview module will be used to conduct preliminary post-processing of EK500 data at sea, which involves removing extraneous bottom echoes or water column noise. Echoview will also be utilized for preliminary partitioning of species-specific (Atlantic herring) acoustic backscatter. EK500 data and Echoview files will be logged and archived directly into the RV Delaware's FSCS system via the ethernet.

Furuno CSH-5 Omni-directional Sonar: The RV Delaware's Furuno CSH-5 omni-directional sonar may be used during the cruise to locate herring aggregation. The omni-directional sonar's external trigger menu must be turned on to eliminate acoustical interference with the EK500 operations. The sonar is hard-wired to the EK500 operation to synchronize their pings. The sonar analog data output can be captured with a video capture board and stored at a rate of every 2 seconds.

High Speed Midwater Rope Trawl (HSMRT): The High Speed Midwater Rope Trawl (HSMRT) is a commercial midwater trawl designed to be fished at high speeds with minimal drag. Its symmetrical four-seam box design has 53.1 m (174') footrope, headrope, and breastlines providing a mouth opening of roughly 400 m² (Fig. 2). The trawl will be rigged with four 54.8 m (179'9") bridles to 1.8 m² US Jet double-foiled suberkrub-type doors with double door weights (Fig. 3). For each side, the total (forward and aft sections) setback will be adjusted to 2.5 m (5') with 600 lb (275 kg) tom-weights. Doors will be attached for maximum spread. The HSMRT will be targeted on acoustical fish signals. Fixed trawl stations will be provided to the officers during the beginning of each cruise, however stations may be dropped, added, or moved depending on the incoming results. The HSMRT will be towed at 4.5 knots during the cruise for typically 30 minute duration, but duration could be reduced if significant numbers of fish enter the trawl according to the ITI and FS903 trawl sensors. The trawl will be fished obliquely by incrementally increasing the wire-out until the trawl is close to the bottom (no closer than 10 m from the bottom). Officers will record the time, date, navigational, and station data in FSCS while the scientists will record the catch and ITI data for each station deployment. Catch data will be recorded using the FSCS on-board entry system.

Simrad FS903 Trawl Monitoring and Third-wire Winch System: The trawl will be monitored using two trawl monitoring systems, referred to as the FS903 and ITI systems. The Simrad FS903 Trawl Monitoring System is a third-wire device that provides real-time sonar images of the trawl opening and performance. The Simrad ITI wireless trawl sensors provides point measurements of the trawl depth, horizontal and vertical opening, and door spread. Minilog depth-temperature probes will also be attached to the trawl headrope and footrope to provide continuous depth-temperature profile data for each deployment.

Fisheries Scientific Computer System (FSCS) and event logging: The RV Delaware's FSCS system is a PC-based server which continuously collects and distributes scientific data from various navigational, oceanographic, meteorological, and sampling sensors throughout the cruise. FSCS is also integrated with biological sampling stations that provides on-board entry of station and catch data. The FSCS EventLog program has also been upgraded for NEFSC Fisheries Acoustic and deployment operations. The FSCS EventLog program will be used by the scientists to

document all operational events (e.g., begin and end of transects and deployments). Date and time for data collections from computers, instrumentation, and logsheets recording will be synchronized using the vessel's GPS master clock.

Static Underwater Stereo Video System: The Static Underwater Stereo Video System (SUSVS) was designed by the NEFSC Fisheries Acoustics Research Group to directly verify acoustic targets. The SUSVS will be deployed midship along-side the acoustic beam of the EK500 while the RV Delaware drifts over backscatter aggregations. Matched underwater video cameras (DSP&L SuperSeaCam 5000) will be mounted in the array to obtain stereo imagery of targets. The cameras have a CCD low-light (10^{-3} lux) sensor with a 97° horizontal and 77° vertical degree angle of view and automatic backlight compensation. Two DSP&L MultiSeaLites provide illumination that can be dimmed remotely using a 120 v voltage regulator. In an effort to further minimize light avoidance by acoustic targets, an intensified CCD video camera (ROS 20/20 with operational ability at 10^{-6} lux) and LED lighting will be tested. A JASCO Attitude Sensor attached to the underwater video array will record real-time depth, temperature, compass bearing, and three-dimensional orientation will be attached to the underwater video system to measure the in-situ orientation of herring which appears to account for a significant portion of the variability in acoustic measurements. Dual video and environmental data will be recorded from the SUSVS through a 330 m multi-conductor cable to digital tape recorders and video-stream to PC hard-drives. The video recordings will be synchronized using a time-code generator and the vessel's GPS clock for accurate analysis in relation to the acoustic data collection.

Conductivity-Temperature-Depth (CTD) Profiler: A Seabird CTD profiler will be deployed at the beginning and ending of each transect, at the beginning of each trawl, and other selected locations to define the hydrographic conditions. Water bottle casts will also be deployed to collect salinity samples each day.

Vemco Minilog Probes: Minilog temperature-depth probes (with a 1 sec sampling rate) will be attached to all scientific gear deployments, including the midwater trawl headrope and footrope.

Biological Sampling: Trawl catches will be sorted by species, weighed and measured (to the nearest cm FL) according to standard NEFSC procedures. Subsamples for Atlantic herring will be taken at each station for detailed lengths (TL and FL in mm), individual weights (to nearest 0.1 g), sex/maturity staging, and otolith samples (freeze herring whole). Stomach contents will be examined at sea from 10 herring per station. The RV Delaware's FSCS system will be used for on-board entry and auditing of trawl station and biological data.

Data Management: All data will be collected using standardized NEFSC procedures and archived into the Northeast Fisheries Science Center's (NEFSC) data management system upon each arrival in Woods Hole, MA. ROSCOP 3 forms (IOC SC-90/WS-23) will be completed and forward to NODC, Washington, D.C. A Cruise Report and completed 'Ship Operations Evaluation Form/ will be submitted by the Chief Scientist to the NEFSC Vessel Coordinator for distribution within 20 days following the completion of the cruise.

Communications: Communications with NOAA Fisheries Research Vessel Delaware II and the Woods Hole (Port Captain) will be conducted using e-mail as the primary source for daily traffic. Radio communications will be guarded by KAC Woods Hole on 2613.0 kHz for any other traffic desired at the discretion of the Commanding Officer or Chief Scientist.

Hazardous Material: Specifications of NC INSTRUCTIONS 6280A will be followed. A list of chemical materials brought aboard ship along with Material Safety Data Sheets will be given to Commanding Officer a minimum of 30 days before departure. With the exception of ethanol and formalin, the scientific program is responsible for providing required handling equipment/apparel and approved neutralizing agents required for the safe use, storage, and handling of all chemical brought aboard.

Medical Clearances: NOAA Fleet Medical Policy requires all personnel embarking on NOAA vessels to furnish a completed copy of the NOAA Health Services Questionnaire (NHSQ) to the Marine Operations Center's Health Service Office no later than seven days in advance of the departure date. The Chief Scientist is responsible for the timely submission of the NHSQs for the scientific personnel.

Marine Mammals: Sightings of right whales, or dead or entangled whales of any species, should be reported following the protocols described on the Critical Sightings Program (CRISP) placard. General opportunistic sightings of marine mammals is voluntary, and should be reported using the Platforms of Opportunity (POP) forms and protocols.

Miscellaneous:

Trawl Warps: The current national protocol for trawl surveys require trawl warps installed on NOAA vessels be measured side by side, and remarked as needed, so that marks are even prior to the start of the survey. Marks should be rechecked at the end of each survey to ensure that mark distances remain in compliance with survey protocols.

Gear repair and inventory: A list of survey sampling gear loaded aboard will be presented to the Lead Fisherman prior to sailing. It is requested that the vessel's crew make efforts to repair damaged nets when damage occurs during

operations. If net repairs can not be performed, the net should be labeled by the Lead Fisherman documenting the details of the damage. The Lead Fisherman will provide the Chief Scientist with the information needed to document the use (or non-use), damage, or loss of sampling gear.

Watches: Vessel operations will be conducted continuously 24 hours per day. Scientific personnel will be on duty 12 hours each day, working a 12 hour "on" and "off" watch schedule.

Meals: A scientific complement of up to 13 persons will be given meals beginning with the day of sailing, extending throughout the cruise, and ending with termination of the cruise.

Post-Cruise Meeting: A formal post-cruise meeting will be held aboard the vessel on completion of the cruise. The Commanding Officer, Port Captain, Scientific Vessel Coordinator, Chief Scientist, and whomever else is detailed will attend. The Port Captain will be responsible for disposition of the minutes of the meeting.

Personnel List (Scientific):^{1/}

Part 1: 7-17 September 2004

<u>Name</u>	<u>Title</u>	<u>Organization</u>
Michael Jech	Chief Scientist	NMFS, NEFSC, Woods Hole, MA
Lisa Bonacci	Watch Chief	NMFS, NEFSC, Woods Hole, MA
To be determined	Watch Chief	NMFS, NEFSC, Woods Hole, MA
Robert Gamble	Contractor	NMFS, NEFSC, Woods Hole, MA
Kristopher Scheppe	Contractor	NMFS, SEFSC, Key West, FL
Sean Lucey	Contractor	Wakefield, RI
Jason Cook	Volunteer	Ocean Journey, Denver, CO
Catherine Perry	Volunteer	Ocean Journey, Denver, CO

Part 2: 20 September - 1 October 2004

<u>Name</u>	<u>Title</u>	<u>Organization</u>
Michael Jech	Chief Scientist	NMFS, NEFSC, Woods Hole, MA
William Michaels	Watch Chief	NMFS, NEFSC, Woods Hole, MA
Lisa Bonacci	Watch Chief	NMFS, NEFSC, Woods Hole, MA
Terry Smith	Fish Biologist	NMFS, NEFSC, Woods Hole, MA
David Chevrier	Computer Program	NMFS, NEFSC, Woods Hole, MA
Sean Lucey	Contractor	Wakefield, RI
Ann Newbold	Contractor	New England Aquarium, Boston, MA
To be determined	Volunteer	

Part 3: 4-15 October 2004

<u>Name</u>	<u>Title</u>	<u>Organization</u>
William Michaels	Chief Scientist	NMFS, NEFSC, Woods Hole, MA
Michael Jech	Watch Chief	NMFS, NEFSC, Woods Hole, MA
Lisa Bonacci	Watch Chief	NMFS, NEFSC, Woods Hole, MA
William Overholtz	Fish Biologist	NMFS, NEFSC, Woods Hole, MA
Sara McNulty	Contractor	NMFS, NEFSC, Gloucester, MA
Allison Glass	Contractor	Weymouth, MA
Geoffrey Shook	Contractor	South Yarmouth, MA
Mario Flores	Visiting Scientist	Morelos Univ. Guadalajara, Mexico

^{1/} Changes to the scientific personnel list will be provided in an Addendum.

Clearances for RV Delaware II Cruise 04-13, Atlantic Herring
Hydroacoustic Survey.

Nicholas A. Prahl
Director

Marine Operations Center

John Boreman (acting)
Science and Research
Director
Northeast Region

Equipment and Supply List: The following scientific equipment will be loaded aboard the RV Delaware II prior to departure:

ITEM	QUANTITY	FURNISHED BY
1. High Speed Midwater Rope Trawl	2	NMFS, NEFSC, Woods Hole, MA
2. Double-foil 1.8 m ² Suberkrub doors	2 pair	" " " "
3. Trawl hardware and mending twine	ample	" " " "
4. Simrad ITI Trawl Monitoring sensors		" " " "
ITI Spreader #1 door sensors	2 pair	" " " "
ITI Spreader #2 wing sensors	1 pair	" " " "
ITI Depth/Temperature sensor	2	" " " "
ITI Height sensor	2	" " " "
5. Methot 7 m ² trawl	1	" " " "
6. Fish checker	1	" " " "
7. Marel electronic scale (for baskets)	2	" " " "
8. Marel electronic scale (for fish)	2	" " " "
9. Special sampling supplies	ample	" " " "
2-bushel fish baskets	10	" " " "
5-gal. buckets	10	" " " "
Fish measuring boards	4	" " " "
Polyethylene specimen bags w/ tags	1 box	" " " "
Gloves, rubberized for sorting fish	36 pair	" " " "
10. Mini-Logger Depth/Temperature probes	4	" " " "
11. SeaBird CTD profiler	2	" " " "
12. Salinity bottles	1 case	" " " "
13. Portable x-ray machine	1	" " " "
14. Fish tank	1	" " " "
15. Downriggers for EK500 calibration	4	" " " "
16. Static Underwater Stereo Video System	1	" " " "
17. Towbody with transducers	1	" " " "
18. Portable Video Winch (hydraulic)	1	" " " "
19. Underwater video supplies	ample	" " " "
20. HP-1600 printer for EK500	2	" " " "
21. Printer paper and cartridges	ample	" " " "
22. Acoustic & video software	ample	" " " "
23. Logsheets (eg. EK500, video, FS903)	ample	" " " "
24. FSCS on-board data entry workstations	2	" " " "
25. PC computers (for data processing)	3	" " " "
26. Simrad EK500 Scientific Sounder	1	FRV DELAWARE II
27. Spare parts for EK500 Equipment	1	" " "
28. FSCS Computer System	1	" " "
29. Simrad FS903 Trawl Monitoring System	1	" " "
30. Spare parts and harness for FS903	ample	" " "
31. Third-wire winch system for FS903	1	" " "
32. Cable block for FS903 third-wire	1	" " "
33. Furuno CSH-5 Omni-directional Sonar	1	" " "
34. Fisheries Scientific Computer System	1	" " "
35. Hydraulic and power installation for portable underwater winch	1	" " "
36. Counter space for data processing	ample	" " "
37. Scientific storage space	ample	" " "

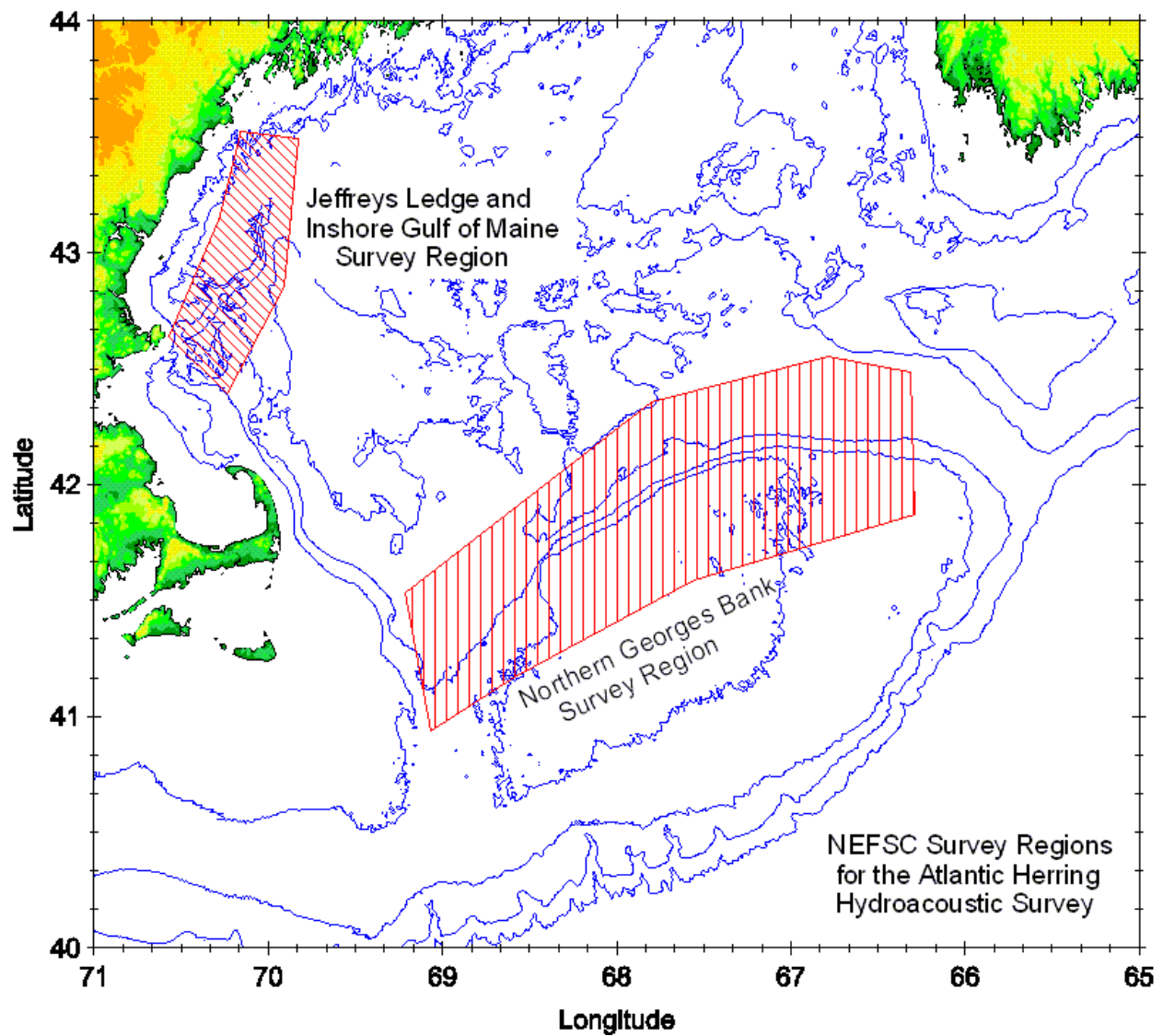


Figure 1. Cruise operational areas hatched regions)for the Atlantic Herring Hydroacoustic Survey, RV Delaware II cruise 04-13.

High Speed Midwater Rope Trawl (Gourock HSMRT design R202825A)

MR. BARRY: Yes.

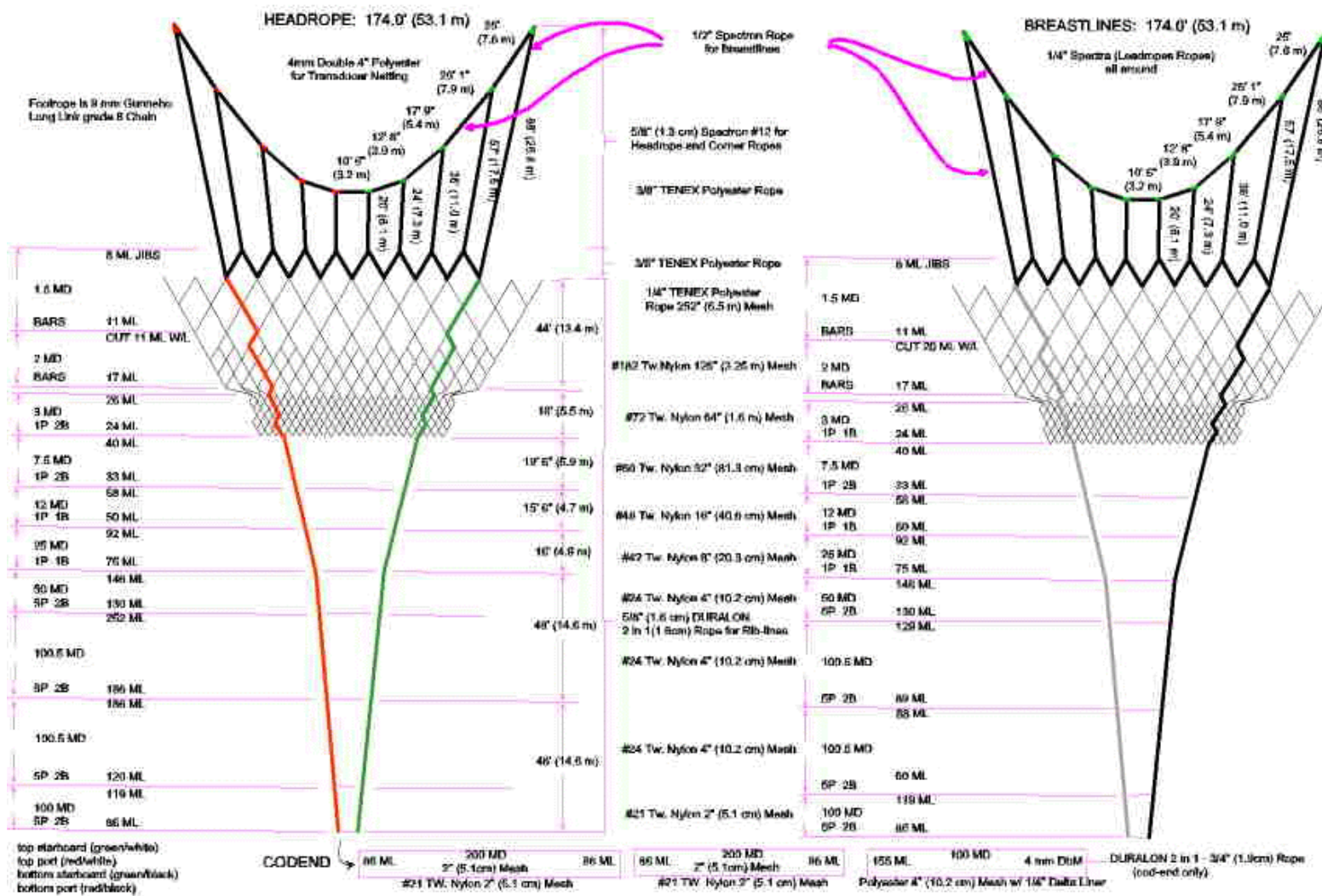


Figure 2. Diagram of the High Speed Midwater Rope Trawl to be deployed during the Atlantic Herring Acoustic Survey, RV Delaware II cruise 04-13.

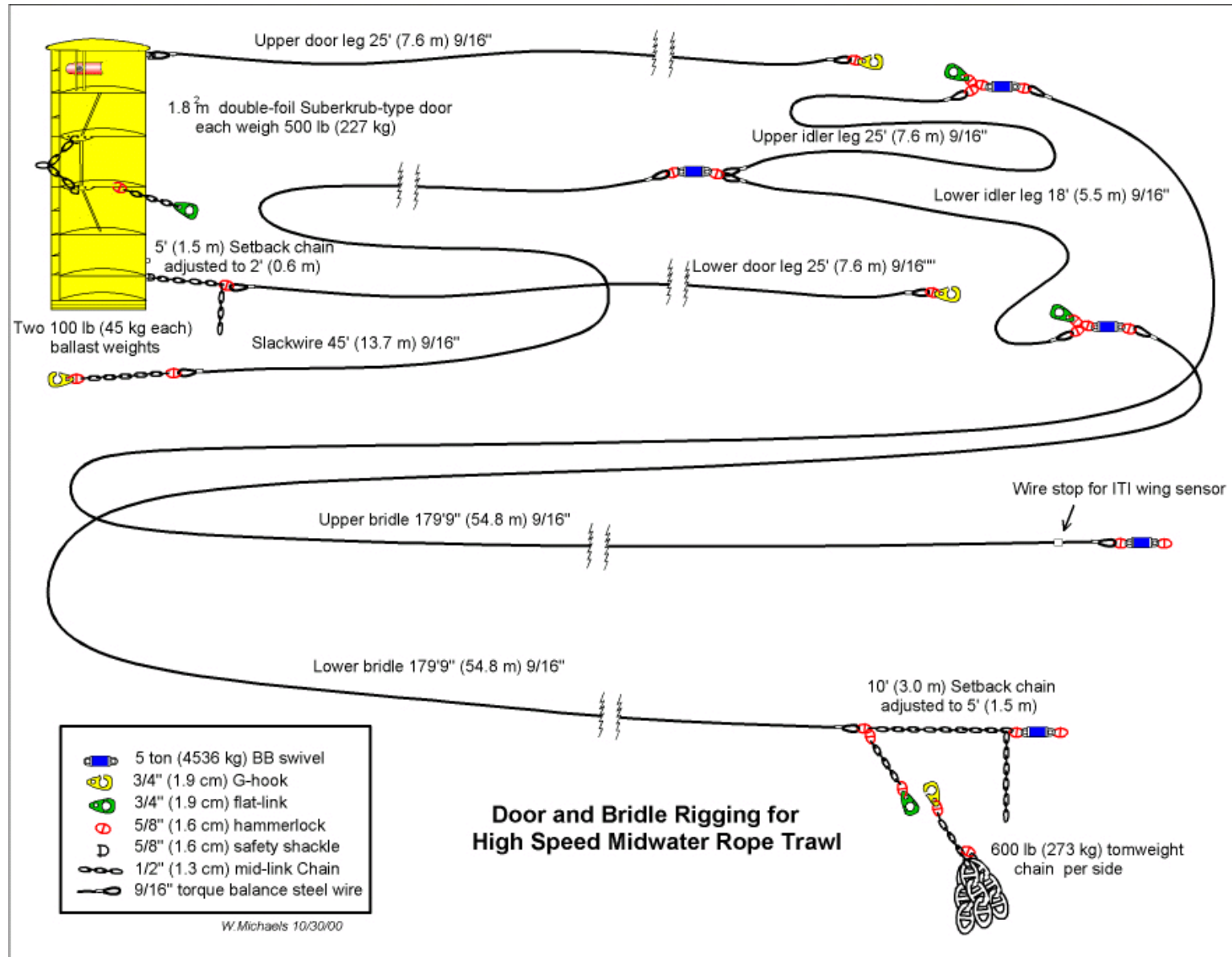


Figure 3. Systematics for rigging the High Speed Midwater Rope Trawl for deployment during the Atlantic Herring Acoustic Survey, RV Delaware II cruise 04-13.